Zoning Regulations (Drainage, N.J.A.C 19:4-8.6)

(a) General requirements for drainage are as follows:

1. Drainage plans shall be signed and sealed by a New Jersey-licensed professional engineer or other professional authorized to prepare drainage plans.
2. All vehicular use areas shall be drained so as to direct surface water runoff to a stormwater drainage system for eventual subsurface or stream disposal.
3. A watershed runoff hydrograph that displays and compares the peak discharge rate and volume shall be prepared for both pre- and post-development conditions. Runoff volume calculations shall be used to determine the sizing of detention facilities, if necessary.
4. The receiving stormwater drainage system (pipe flow or open channel flow) shall be analyzed to ensure that it has the additional capacity necessary to handle any increase in stormwater flow using the Manning equation in Figure 8-4 in (b)4i below. If the receiving stormwater drainage system is at or over capacity, detention facilities shall be provided in order to maintain site runoff at pre-development levels.
5. The size of the drainage area shall include on-site and off-site lands contributing stormwater to the discharge point.
6. Water quality basins or other structures or water quality methodologies approved on a case-by-case basis by the NJMC shall be provided.
7. A maintenance plan for stormwater drainage systems shall be provided to ensure proper function and operation of the system.

(b) Design requirements for drainage are as follows:

1. The applicant shall provide information sufficient for the NJMC to determine compliance with the applicable sections of N.J.A.C. 7:8, NJDEP's Stormwater Management Rules.
2. All drainage systems shall be designed for a 25-year storm event.
3. Runoff estimation:
   i. The Rational Method, utilizing the rational formula listed in Figure 8-2 below, shall be used for computing the runoff of any drainage area up to 20 acres for each discharge point. For areas larger than 20 acres, the U.S. National Resources Conservation Service (NRCS), Technical Release No. 55 (TR-55), "Urban Hydrology for Small Watersheds," incorporated herein by reference, as amended and supplemented, or equivalent approved by the NJMC, shall be used, a copy of which may obtained from the New Jersey Natural Resources Conservation Service located at 51 Gibraltar Drive, Suite 2E, Morris Plains, NJ 07950; and

Figure 8-2
Rational Formula

$$Q = ciA$$

where:

Q= Peak flow in cubic feet per second (cfs)
c = Runoff coefficient (weighted)
i = Rainfall intensity in inches per hour (in/hr)
A= Drainage area in acres (ac)

ii. The runoff coefficients (c) listed in Table 8-2 below shall be used in the rational formula

Table 8-2
Coefficient of Runoff Values

Land Use	Description	Hydrologic Soils Group			
		A	B	C	D
Cultivated Land:	Without conservation treatment	0.50	0.70	0.80	0.90
	With conservation treatment	0.30	0.45	0.65	0.70
Pasture:	Poor condition	0.40	0.65	0.75	0.85
Grassland or Range Land	Fair condition	-------	0.25	0.50	0.65
Meadow	Good condition	-------	------	0.40	0.60
			-		
Wood or Forest Land:	Poor cover; thin stand, no mulch	-------	0.35	0.60	0.70
	Good cover	-------	------	0.45	0.60
			-		
Open Space:	Poor Condition (grass cover < 50%)	-------	0.65	0.70	0.85
Lawns, Parks, Golf	Fair Condition (grass cover 50% to 75%)	-------	0.45	0.60	0.75
Courses, etc.)	Good Condition (grass cover > 75%)	-------	0.25	0.50	0.65
Urban Areas:					
Commercial and Business	85% impervious	0.85	0.90	0.90	0.95
Industrial	72% impervious	0.65	0.80	0.90	0.90
Residential:					
Average Lot Size (acres):	Average % impervious:				
1/8	65	0.60	0.75	0.85	0.90
¼	38	0.30	0.55	0.70	0.80
1/3	30	-------	0.50	0.70	0.80
½	25	-------	0.45	0.65	0.75
1	20	-------	0.40	0.65	0.75
Impervious Areas:	Parking lots, roofs, driveways, etc.	0.99	0.99	0.99	0.99
Paved	Streets and roads	0.99	0.99	0.99	0.99
Gravel	Streets and roads	0.60	0.75	0.85	0.90
Dirt	Streets and roads	0.50	0.70	0.80	0.85

Note: Hydrologic Soil Groups texture descriptions are the following:
A Sand, loamy sand, or sandy loam
B Silt loam or loam
C Sandy clay loam
D Clay loam, silty clay loam, sandy clay, silty clay, or clay.

iii. The time of concentration (T_c) used in the rational method shall be calculated using the NRCS TR-55 methodology or other method approved on a case-by-case basis by the NJMC.

4. Stormwater drainage collection system design requirements are as follows:

i. The design of pipes and conduits shall use Manning's equation, listed in Figure 8-3 below, to determine capacity.

Figure 8-3
Manning's Equation

$$Q = (1.486/n)AR^{2/3} S^{1/2}$$

where:

Q= Flow, cubic feet per second (cfs)

n = Manning's roughness coefficient
A= Cross-sectional area of flow in square feet (sf)
R= Hydraulic radius in feet, R=A/P, where P is the wetted perimeter, measured in feet and defined as the length of the line of contact between the flowing water and the channel(ft)
S= Slope of energy grade in feet per foot (ft/ft)

ii. Pipe sizes shall be determined using the design runoff, conduit entrance conditions and hydraulic capacity.

iii. Design velocities in pipes shall be a minimum of two feet per second, or as otherwise approved on a case-by-case basis by the NJMC, to allow for self-cleaning and a maximum of fifteen feet per second to prevent scouring of pipes, manholes, and inlets and erosion at points of discharge.

iv. The materials used in the construction of storm sewers shall be reinforced concrete, ductile iron, corrugated polyethylene, or other as approved by NJMC. Corrugated metal and steel shall not be permitted.

v. The Manning's roughness coefficient "n" for circular cross section, nonporous concrete pipe shall be 0.013. Other cross sections or pipe materials shall have commensurate friction factors.

vi. All transitions in pipe slopes, junctions and changes in pipe sizes shall be confined to manholes, catch basins, or other accessible structures designed for one or more of these purposes.

vii. Where a drainage system discharges to a tidal waterway, tide gates, constructed of cast iron or other corrosion-proof material, shall be provided at every discharge point.

viii. Where a drainage system starts at or discharges into a stream, ditch or other body of water, a concrete headwall with wing-walls and a rip-rap apron pad, or other as approved by the NJMC, shall be constructed.

ix. Roof runoff shall be conveyed via roof leaders to an underground drainage system, where feasible.

5. Detention basin design requirements are as follows:
    i. Underground detention basins may be provided utilizing solid material pipe or perforated pipe. If perforated pipe is utilized, the percolation rate of the underlying material shall be adequate to ensure that the water table is at an elevation that allows the detention system to empty.
    ii. Detention basins shall accommodate site runoff generated from 25-year design storm events so that pre-development peak flow rates at the critical time of concentration are not increased.
    iii. Detention basins shall be analyzed for a 100-year storm event to ensure stability of downstream structures and stormwater management systems.
    iv. In order to address water quality, detention basins shall be designed for the water quality design storm of 1.25 inches of rainfall falling uniformly in two hours, such that no more than 90 percent will be discharged prior to 36 hours, or 18 hours for residential development.
    v. Detention basins shall be equipped with water control structures consisting of orifice and/or weir control devices. The minimum diameter of any outlet orifice shall be 2½ inches.
    vi. The sides of a detention basin shall not exceed a slope of 3:1, unless otherwise approved by the NJMC. In order to control erosion, the sides of the detention basin shall be planted with suitable landscape material.
    vii. Detention basins shall be maintained to prevent clogging and/or siltation. A maintenance plan shall be submitted to the NJMC for review and approval.
6. Stormwater pollutant removal requirements are as follows:
    i. Install best management practices (BMP) to provide total suspended solids (TSS) load removal to the maximum extent feasible for post-construction runoff.
    ii. Acceptable BMPs include extended detention basins, manufactured treatment devices, sand filters, constructed stormwater wetlands, infiltration systems, pervious pavement, wet ponds, and others, as approved by the NJMC.